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SHELDON FLATS THINNING AND ENGRAVER BEETLE TRAPPING LIBBY RANGER DISTRICT, 1997-1998 A Case Study

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Introduction

During 1996, personnel from Libby Ranger District, Kootenai National Forest, began proposing a thinning/fire-hazard reduction project in the Sheldon Flats area, north of Libby, Montana. There, home development in the "forest/urban interface" had resulted in the need to address stand structure, forest health and fire potential. The area, approximately 1,200 acres in size, was comprised of predominantly second-growth ponderosa pine, about 65-70 years old. In parts of the area, there were varying amounts of western larch, Douglas-fir, and lodgepole pine; but ponderosa pine was the dominant tree species throughout. Tree diameters ranged from 6-14 inches, with most in the 10- to 12-inch class.

Implemented on about 800 of the 1,200 acres, the primary purpose of the proposed action was to reduce fuel loading and fire hazard in a two-entry commercial thin. Half of the area was treated during FY97, the other half in FY98. Originally, there were several hundred trees per acre and basal area averaged around 120 square feet per acre. Treatments ultimately reduced stocking to about 60 trees, and approximately 60 square feet basal area, per acre. Healthy, vigorous ponderosa pine was favored for retention during thinning; however, large-diameter trees of other species (Douglas-fir and western larch) were left as well. Understory vegetation less than 3 inches diameter at breast height (d.b.h) was later slashed, and future treatments included short-interval underburns, which developed a more naturally appearing, open-grown stand of large-diameter trees.

In addition to fire-hazard reduction, another incentive for the project was to reduce future threats from several bark beetle species, among them, mountain pine beetle (*Dendroctonus ponderosae* Hopkins), western pine beetle (*D. brevicomis* LeConte) and pine engravers (*Ips pini* [Say]). Mountain pine beetle populations are periodically high in that area and are always

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a threat to over-stocked, second-growth ponderosa pine stands when they reach average diameters exceeding about 10 inches, and basal area stocking greater than 150 square feet per acre. Western pine beetles can also be damaging in densely stocked ponderosa pine stands during times of unusually dry spring and summer weather. In addition, top-killing or whole-tree mortality, attributable to engraver beetles, is always a concern when partial cutting in ponderosa pine.

Implementation of the thinning project began in winter 1997-98. Trees removed were whole trees skidded to landings where tops and limbs were piled. Piles were to be burned in late summer/early fall, 1998. Knowing the potential for engraver beetle build-ups in slash piles, and subsequent tree- or top-killing was great; district personnel elected to carry out ameliorating actions, in the form of pheromone-baited funnel traps during late spring and early summer, 1998.

Following is a review of pine engraver life cycle and damage potential, as described in Forest Insect and Disease Leaflet #122, "Pine Engraver, *Ips pini* (Say), in the Western United States" (Kegley, et al. 1997). Such an examination might be helpful in more fully understanding how beetles may affect management decisions and why trapping alternatives were selected for Sheldon Flats.

Engraver Beetle Life Cycle and Ecology

Attacks are initiated by male beetles which bore into the inner bark and excavate a nuptial chamber. Pheromone attractants released by the male attract one to seven females, though typically two or three. After mating, each female constructs a tunnel or "egg gallery" in the phloem layer. During gallery construction, boring dust is pushed to the outside, clearing the nuptial chamber and egg galleries. Additional males are also attracted to the vicinity of the initial attack. The attractant pheromone promotes an aggregation of beetles or "mass attack."

A female lays from 30 to 60 eggs along the sides of the egg gallery, which usually ranges from 4 to 7 inches long. Eggs hatch within 4 to 14 days, and larvae mine laterally from the egg gallery for 1 to 2 inches. Larval mines, unlike parent tunnels, are packed with shredded phloem and excrement collectively called "frass." Larvae feed for 2-4 weeks and then excavate an oval cell at the end of their tunnels where pupation occurs. New adults begin to appear about 12 days after pupation, or about 40-55 days after the initial attack by parent beetles. When mature, new adults bore through the bark and emerge to make new attacks. This second flight occurs, in our part of Montana, about mid-June. That is the flight most responsible for mid-summer standing-tree mortality. Brood from that generation emerge later in the summer—typically during August, and it is during this period that large numbers of beetles may infest living trees during "feeding" attacks. During this time, they mine extensive maze-like galleries under the bark without producing brood. Occasionally these feeding attacks may result in tree mortality.

Beetles spend the winter almost exclusively in the adult stage, except in warmer, drier areas where some older larvae and pupae may overwinter. Adults overwinter under the bark of infested trees and slash or in duff and litter on the forest floor.

In most parts of the beetle's range, two or three generations per year are common. The first flight usually begins in April or May when daily maximum temperatures reach 60-70 degrees. As overwintering beetles become active, they infest fresh slash or trees damaged by wind or snow. This generation normally does not successfully attack standing green trees. However, populations can build up in slash with subsequent generations attacking and killing live trees, although if new slash is available, it will be infested first.

Predicting Outbreaks

The percentage of normal precipitation between April and July may be used to predict the intensity of pine engraver outbreaks later in the season. If precipitation is 75 percent of normal or less, moderate to heavy tree mortality may be expected in overstocked, second-growth ponderosa pine stands. Outbreaks are usually of short duration, seldom lasting more than one season. During extreme droughty conditions, damage may continue for 2 to 3 years.

Minimizing Tree Mortality

The key to preventing tree damage is the promotion of healthy forests. Trees in thinned, vigorous stands are infrequently colonized by pine engraver beetles. During drought years, maintaining stand vigor is even more important. Stands in which basal area has been reduced to 80-100 square feet per acre have been found to be less susceptible to beetle attack.

Most pine engraver problems are associated with disturbances such as windthrow and snow breakage, drought in spring and early summer, logging, fires, road construction, housing development or other human activities. Pine slash or weakened trees created by these disturbances attract beetles and provide ideal conditions for population buildup and subsequent tree killing.

Because pine engraver beetles overwinter as adults and normally only infest fresh slash when they emerge in the spring, logging slash created from early winter through late spring can be especially hazardous by providing large amounts of breeding material. Slash should not be created during this period unless it can be treated prior to beetle emergence.

The optimum period for logging activity in ponderosa pine is late summer to early winter. Slash created at this time will usually dry sufficiently to be unsuitable for pine engravers by the following spring. Slash covered by early snows; however, may still be fresh enough to attract beetles in the spring. Creating slash from about January through July, increases the likelihood of subsequent tree killing. When it is not practical to avoid creating slash during high-risk months, several management practices can be used to help minimize potential impacts:

a. Prompt slash disposal. Bulldozer trampling or chipping effectively reduces the amount of breeding material by decreasing the size of logging debris and by removing and drying the bark. Burning slash while still green also destroys potential brood sites. When burning slash, however, avoid scorching standing trees. Fire injury makes them more attractive to various species of bark- and wood-boring insects. When chipping slash, we have learned it is best not to deposit chips in host stands during beetle flight periods.

b. Where slash disposal is impractical, lopping into smaller pieces and scattering it into openings is effective. Reducing the size and exposing the slash to direct sunlight dries it faster making it less suitable for beetle development.

c. When beetle populations in slash constitute a threat, creating a continuous supply of fresh slash during the flight period of emerging adults will generally attract beetles, keeping them out of standing green trees. This technique is known as providing a "green chain." New slash should be produced just as beetles enter the pupal stage. Once started, this technique should be continued for each generation that season.

An alternative to this method is the creation of very large slash piles in the spring before initial beetle flight. If piles are big enough, interior pieces will not dry before beetles from the initial generation emerge. Emerging beetles are attracted deeper into the pile, keeping them out of standing trees. Piles should be at least 20 feet wide and 10 feet deep, and distributed throughout the treated area. This method has been used successfully in the northern portion of the beetle's range (Knopf 1982).

d. During logging, felling trees into openings and using established skid trails to avoid damaging the residual stand are good practices to reduce pine engraver attacks on the remaining trees. Trees whose roots are exposed or disturbed, and those with large patches of bark torn off should be removed.

e. An additional method, the one chosen for Sheldon Flats, entails the use of pheromone-baited funnel traps to capture beetles emerging from small, infested slash piles. Traps are hung around infested piles, typically during the latter part of May (in Montana and northern Idaho), and will attract emerging beetles into traps, keeping them from infesting surrounding trees. While more labor intensive, this method has been used successfully. Still, it should be considered secondary to proper slash treatment.

Sheldon Flats Thinning Project

Initial thinning was completed during late winter-early spring, 1998. Several hundred acres were thinned, throughout which logging residues were

piled into 43 piles. Slash piles varied from 10 feet to 100 feet in diameter and 6 to 10 feet deep. Because slash piles varied as much as they did, and there was a desire to lose no leave trees, if at all possible, we decided to place pheromone traps around each pile, **after** they were infested. We did not hang traps prior to beetle flight, in an attempt to prevent slash pile infestation. We had tried such a technique several years earlier, with poor results (Gibson, unpublished office data).

We do not have the precise date recorded when initial attacks began; but because spring 1998 was atypically warm and dry; attacks may have begun in early- to mid-April.

Engraver Beetle Population-Reduction Trapping

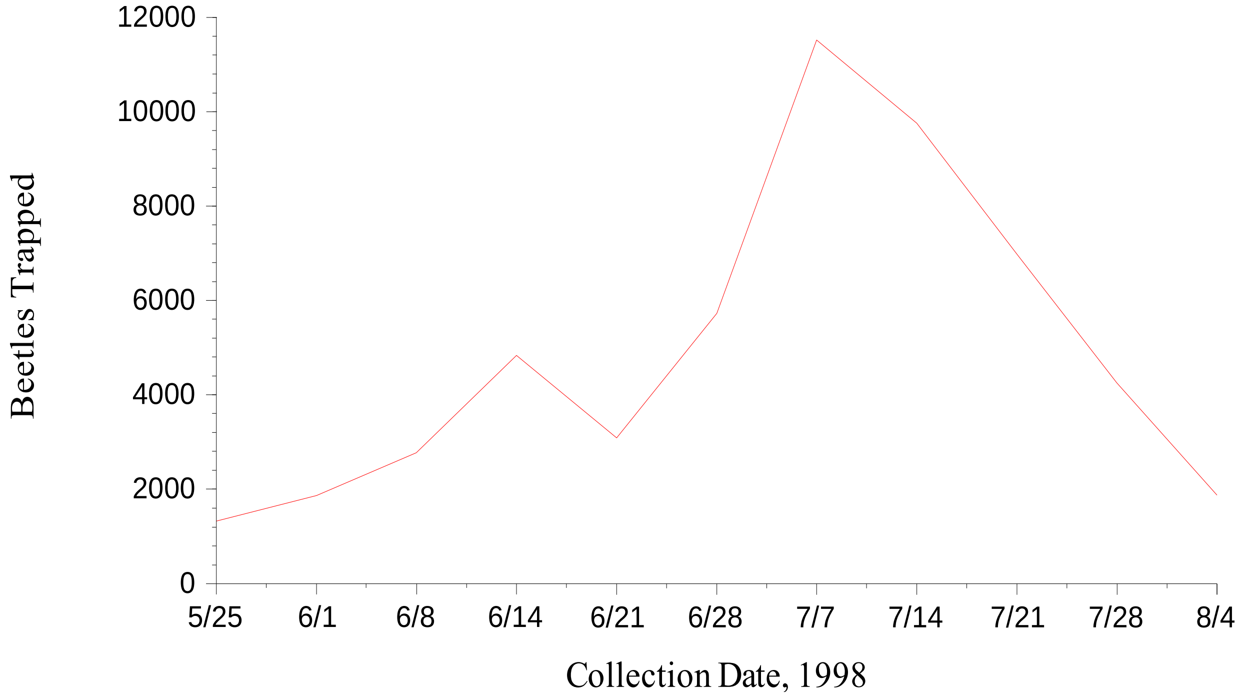
By the end of beetle flight period, all slash piles were heavily infested by engraver beetles. While some piles were probably large enough to contain beetles of succeeding generations, pheromone-baited funnel traps were hung around each pile to attract emerging beetles and help assure no leave trees were attacked during subsequent dispersal flights.

A similar use of traps, but used in an area where wind, ice, and snow had broken tops and limbs from mature ponderosa pine over a large area during winter 1996-97, was described by Kegley (1998). In that situation, broken and wind-deposited material was not cleared from the area prior to beetle flight in spring 1997. It was subsequently infested heavily by engraver beetles. Because the infested material could not be removed before beetle emergence, traps were hung throughout the area before emergence began in spring 1997. Many beetles were collected and no green-tree mortality was observed anywhere in the area (Kegley 1998).

In the Sheldon Flats area, traps—3 to 4 around each pile—were hung in early May; after initial flights were over, but before brood development was completed. Traps were standard 8-funnel, Lindgren traps, baited with the commercially available *I. pini* lure—lanierone and ipsdienol. Traps were hung on tripods constructed from iron, concrete-reinforcing rods, cut to lengths of about 10 feet.

Traps were emptied weekly, from May 25 to August 4 when trap catches had declined markedly. Traps were removed and slash piles were subsequently burned. Around 43 slash piles, we hung 128 traps. First beetles were collected May 25, peak flight occurred about July 7, and last beetles were collected on August 4 (though flights may not have been entirely over). In total, an estimated 54,200 beetles were collected—an average of more than 400 per trap (figure 1).

Figure 1. ENGRAVER BEETLE TRAP CATCHES--1998[1]



[1] Trap catches from 128 traps, surrounding 43 slash piles. Estimated beetles: 54,200; Peak Flight: July 7-14.

Conclusion

Through 1998, we found no engraver beetle-attacked trees in the Sheldon Flats area. Because it seems likely the 54,000 beetles trapped would have infested tops or trees had they not been attracted to traps, we considered the trapping effort successful. Subsequent aerial and ground surveys throughout that part of the district revealed only endemic-level tree mortality associated with drought-related conditions prevalent in that area during the ensuing several years. All indications over the period since trapping was completed suggest trapping successfully prevented engraver beetle-caused mortality in the treatment area.

This project was essentially a “case study”—operational more than experimental—and therefore not particularly amenable to statistical analysis. However, it did provide additional evidence in support of Kegley's earlier work (1998), relative to the use of pheromone traps to reduce engraver beetle-caused damage during mid-summer flights. And because a portion of our success may have been due to the size of slash piles created in the area, it likewise supports Knopf's observations of more than 20 years ago (Knopf 1982).

Though trap installation and monitoring was labor-intensive, and similar projects would have to be assessed on their own unique conditions; the desire to preserve and maintain as many "leave" trees as possible justified that expense in Sheldon Flats. Whether such a procedure should be considered "operational," appropriate for another time and place, is conjectural. It does; however, seem to have been a prudent choice for Sheldon Flats.

References

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